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JERROLD®

INSTRUCTION MANUAL 435-276

FIELD STRENGTH METER
MODEL 727

JERROLD ELECTRONICS CORPORATION

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INSTRUCTION MANUAL
435 - 267

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Philadelphia, Pa. U.S.A.

FIELD STRENGTH METER MODEL 727
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TABLE OF CONTENTS

	Pages
Model 727 Description	1
Specifications	2
Chart of Operating Controls and Their Functions	3-4
Operation	5-6
Applications	7-16
Field Intensity Survey	7
Orienting Antennas	7-8
Measuring Gain and Loss	8
Measurement of Noise Levels	8-10
Noise Calibration of a Model 727	10-11
Measurement of Percent Cross-Modulation	11-15
Measurement of Hum Modulation	15-16
Functional Block Diagram	17
Circuit Description	18-21
General	18
Attenuator	18-19
Bandpass Filters	19
VHF Tuner	19
Mixer	19
I-F Amplifier	19-20
Video Detector	20
Discriminator	20
Audio Amplifier	20
Peak Detector	20
Power Supply	21
Maintenance	22-32
General	22
Calibration	22-28
I-F Alignment	28-32
Replacement Parts Lists	33-42
Schematic Circuit Diagrams	DWG. No.
Main Assembly	861-829
V. H. F. Tuner	861-779

FIELD STRENGTH METER MODEL 727

DESCRIPTION

Model 727 is a tunable r-f voltmeter designed for measuring signal levels between 10 microvolts and 3 volts in the frequency range from 5 to 216 MHz. An accessory plug-in converter is available on special order for extending the operating range into the 470 to 890 MHz u.h.f. band.

The instrument consists essentially of a tuner/local oscillator unit, a balanced mixer, an i - f amplifier, and a peak detector measuring circuit. A step attenuator in the input circuit permits setting the measurement range. Frequencies can be tuned in four switch-operated ranges.

The 727 also includes a video detector whose output is available at a front panel terminal. A discriminator, an audio amplifier, and a loudspeaker are incorporated to help in the identification of interfering signal sources. The metered signal current is also available at a rear panel phone jack for application to a strip chart recorder or similar device.

Special sampling circuitry permits identification of the meter scale from which to take a reading, simply by depressing a front panel switch.

Model 727 may be powered from a 117 volt a.c. line source, from an external 12 to 15 volt battery, or from its own internal, rechargeable, nickel-cadmium battery.

Each instrument is accompanied by a calibration chart inserted in a special holder in the lid; the compensator calibration points are factory-inserted on the chart. In addition, a matching transformer Jerrold Model MT-727 is shipped with each instrument for matching a 300-ohm line to the 75-ohm VHF INPUT terminal on the 727 front panel. This transformer is usable over the 54 to 216 MHz range. A separate matching transformer Jerrold Model MTU-727 is supplied with the accessory u.h.f. adapter for the 470 to 890 MHz range.

FIELD STRENGTH METER MODEL 727

SPECIFICATIONS

FREQUENCY RANGE Tuning Range A B C D	5 to 50 MHz, 54 to 216 MHz, in 4 bands 5 to 50 MHz 54 to 108 MHz 108 to 162 MHz 162 to 216 MHz
MEASUREMENT RANGE full scale reading	10 microvolt to 3 volt in 10 ranges 0.1 mV, 0.3 mV, 1.0 mV, 3.0 mV, 10.0 mV, 30.0 mV, 0.1 V, 0.3 V, 1.0 V, 3.0 V.
ACCURACY OF LEVEL READINGS	$\pm$ 1.5 dB at 25°C, $\pm$ 3 dB from -18°C to +60°C
VIDEO OUTPUT CAPABILITY	0.8 V p-p for +10 dBmV input, with compensator control set for no overload.
MAXIMUM SENSITIVITY	10 microvolt
SELECTIVITY	i-f bandwidth of 0.6 MHz at 3-dB points.
REJECTION OF ADJACENT SOUND CARRIER	50 dB down from level of received video carrier.
INPUT IMPEDANCE AND MATCH above 100 microvolt	75 ohm, VSWR 1.22:1 (20 dB min. return loss) (not matched below 100 microvolt)
INTERMEDIATE FREQUENCY	52 MHz
POWER REQUIREMENTS	A.C. Line: 2 W, 90-130 V, 0.3 A max. Internal Battery: 12 V, 0.6 Ah, 30-40 mA External Battery: 12 - 15 V
AMBIENT OPERATING TEMP. RGE.	-18°C to +60°C
AMB. STORAGE TEMP. LIMITS	-40°C to +60°C

All data subject to change without notice.

FIELD STRENGTH METER MODEL 727

CHART OF OPERATING CONTROLS AND THEIR FUNCTIONS

FRONT PANEL

NAME*	TYPE and SCHEMATIC DESIGNATION	POSITION*	FUNCTION
CHARGE	Lamp, DS2	---	Indicates unit is operating to charge internal battery
VIDEO OUTPUT	Coaxial fitting	---	For connection of an oscilloscope
AC	Neon lamp, DS1	---	Indicates unit is operating from 117 V line
PUSH-TUNER COMP	Potentiometer and spst switch R210/S201	pushed in 0-10	Permits calibration of unit over its frequency range
PULL-MAN GAIN		pulled out	Provides uncalibrated 27 dB range gain control for the i-f amplifier; the meter readings are relative with the control in this position
power selector	Rotary switch S1-A, S1-B	OFF INT BATT EXT BATT CHG	De-energizes the instrument Connects internal battery Connects external battery Permits charging int. battery from 117 V line
DIAL LIGHTS	Pushbutton switch S2	---	Controls tuning dial lights and meter lights
UHF/VHF	Slide switch S101	UHF	Connects the u.h.f. converter output for measurement
		VHF	Connects the v.h.f. input for measurement
VHF INPUT	Coaxial fitting J801	---	For connecting v.h.f. signal source
10 dB, 20 dB	Slide switches S102 thru S106	IN	Insert attenuation for selection of measurement range
		OUT	Remove attenuation
METER RANGE	Toggle switch, spring-loaded, S4	down	Connects sampling network into metering circuit to indicate meter scale

continued

* Capitalized NAMES and POSITIONS are silk-screened on the unit.

FRONT PANEL continued

meter	0-200 uA meter M1	0-300 and 0-100 scales, black	Indicate voltage levels
		-10 to +10 dB scale, red	Indicates dB levels
		VOLTS/MILLI-VOLTS scale, black	Indicates measurement range in volt
		BATT mark, red	Indicates full charge on internal or external battery when BATT CHECK switch is pressed
TUNING	Inductive, L402, L405, L408, L411	clockwise and counter-clock-wise	Permits tuning to desired frequencies
	Dial	A, B, C, and D scales	Indicate tuning ranges; black bands indicate ranges between video and sound carriers of each v.h.f. TV channel
BATT CHECK	Pushbutton switch, S5	depressed	Permits checking charge on internal or external battery, and output voltage of internal power supply when unit is connected to 117 V line
VOLUME	Potentiometer and spst switch, R7/S6	OFF	De-energizes audio amplifier
		---	Controls audio volume
frequency range selector	Rotary switch, S701	A/5-50MHz	Selects: 5 - 50 MHz range
		B/54-108MHz	54 - 108 MHz range
		D/108-162MHz	108 - 162 MHz range
		C/162-216MHz	162 - 216 MHz range
		UHF	operation with u.h.f. adapter

REAR PANEL

RECORDER	Phone jack, J1	---	Permits connection of a recording device
FUSE 0.5 A	3AG, F1	---	Protects instrument against surge currents
-(BLK)EXT	Tip jack, black, J4	---	Permit connection of instrument to external battery
+(RED)BATT	Tip jack, red, J3	---	
117 VAC 50/60	Recessed, 3-prong male jack, J1	---	Accepts female plug of line cord

OPERATION

SETTING THE MEASUREMENT RANGE

Table 1 lists all the measurement ranges obtainable from settings of the 727 attenuator switches. Each measurement range can be checked and identified simply by pressing the METER RANGE switch. Note that the "1" ranges are on the lower (0-100) mV scale and the "3" ranges are on the upper (0-300) mV scale. The dBmV figures in the table indicate the signal level for a 0 (zero) reading on the dB scale.

TABLE 1

ATTEN. SETTING dB	MEASUREMENT RANGE mV or V	dBmV	USE mV SCALE	ATTEN. SETTING dB	MEASUREMENT RANGE mV or V	dBmV	USE mV SCALE
0	0.1 mV	-30	0-100	50	30.0 mV	+20	0-300
10	0.3 mV	-20	0-300	60	0.1 V	+30	0-100
20	1.0 mV	-10	0-100	70	0.3 V	+40	0-300
30	3.0 mV	0	0-300	80	1.0 V	+50	0-100
40	10.0 mV	+10	0-100	90	3.0 V	+60	0-300

USING THE dB AND dBmV SCALES

Model 727 is calibrated to read signal levels directly in microvolt rms; however, dB and dBmV scales are included for applications where signal level is more conveniently expressed in these terms.

For example: Assume a 600-microvolt signal is being measured with the 727 operating in the 1 mV/-10 dBmV measurement range. A 600 uV reading corresponds to a 5.5 dB reading on the dB scale. Adding algebraically -10 and +5.5 we get -4.5 dBmV for the signal level.

MEASURING V.H.F. SIGNAL LEVELS

1. Set the power selector switch according to the power source to be used.
2. If a 117 V line source is to be used, remove the line cord from its compartment at the rear of the instrument and connect the cord there to the recessed 3-prong jack.
3. If an external battery is to be used, connect the battery leads to the red positive and black negative tip jacks at the rear of the instrument. Take care in observing polarity and heed the caution on the label.
4. When using an internal or external battery, press the BATT CHECK switch to see that the meter needle points to the red BATT mark on the meter scale. This check will also indicate the correctness of the internal power supply output voltage when the instrument is operated from a 117 V line.
5. Connect the v.h.f. signal source to the VHF INPUT terminal on the 727 front panel. Where a 300-ohm impedance line is to be connected, first connect the impedance matching transformer Model MT-727 to the VHF INPUT terminal, then connect the 300-ohm line to the screw terminals on the transformer. The latter is shipped inside the drawer of the 727 where the u.h.f. adapter is plugged in when required.

6. Set the UHF/VHF switch to VHF.
7. Set the tuning range selector switch as required.
8. Push in the compensator control and turn it to the setting indicated on the calibration chart in the lid of the 727 for a frequency nearest that of the signal under test.
9. Tune the 727 back and forth past the signal frequency, adjusting the attenuator until the meter indicates between 0 and +10 on the dB scale when the 727 is tuned for maximum reading (this condition will not be attainable for readings below 30 microvolt).
10. Press the METER RANGE switch and note the measurement range indicated by the meter needle.
11. Release the switch and read the signal level.
12. When using the v.h.f. matching transformer Model MT-727, add 6 dB to all dB readings and double all voltage readings to obtain correct figures.

APPLICATIONS

1. GENERAL

Model 727 has application where measurements of relative or absolute r-f signal levels are to be made. In addition, the video detector in the unit allows application in the measurement of a detected signal on a calibrated oscilloscope. This section of the manual describes how to use the instrument for various kinds of r-f measurements.

2. FIELD INTENSITY SURVEYS

Model 727 can be used together with a 75-ohm resonant dipole for plotting detailed field intensity contour maps necessary for choosing antenna sites for CATV systems. For these measurements the 727 and the antenna are moved about in a vehicle and signal strength readings are plotted on an area map. These readings are then converted to field strength indications using the following equation:

$E = 0.021\,fV$; where E is the field strength in uV/m (microvolt per meter),
f is the signal frequency in MHz, and
V is the 727 reading in uV.

Table 2 is the result of using this equation to obtain conversion factors (C) for the video carrier frequency of every v.h.f. television channel. Using these factors, the above equation reduces to : $E=CV$.

TABLE 2

Channel	C
2	1.20
3	1.32
4	1.45
5	1.66
6	1.79
7	3.72
8	3.84
9	3.97
10	4.10
11	4.22
12	4.35
13	4.47

If an antenna other than a resonant dipole is used for making the measurements, the gain factor (G) of the antenna must be taken into account (for example, for an antenna with 20 dB of gain, the gain factor G=10) and the equations become:

$$E = \frac{0.021fV}{G} \text{ and}$$

$$E = \frac{C\,V}{G}$$

3. ORIENTING ANTENNAS

Model 727 can be employed for orienting antennas for best reception. The antenna down lead is connected to the VHF INPUT terminal (if necessary, through the matching transformer) and the antenna is then oriented for maximum reading of the video carrier signal on the 727.

For the case of a single-channel antenna, the 727 is tuned to the video carrier of the channel and the antenna is oriented according to the reading on the 727.

For the case of broadband antennas, the 727 reading is maximized for the video carrier of each channel to be received, noting the reading and orientation for each channel. A compromise orientation is then selected on the basis of these readings and orientations. Readings are repeated for each channel with the antenna in the compromise orientation to assure that adequate signal strength is available for each channel. The procedure for f-m antennas is the same as that for broadband antennnas.

4. MEASURING GAIN AND LOSS

For measuring gain or loss of a circuit at specific frequencies, set up the equipment as shown in Fig. 1.

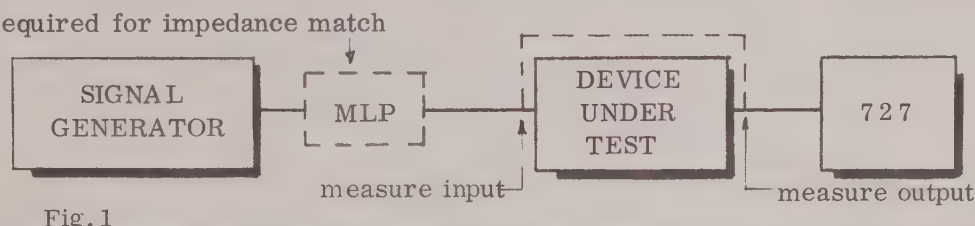


Fig. 1

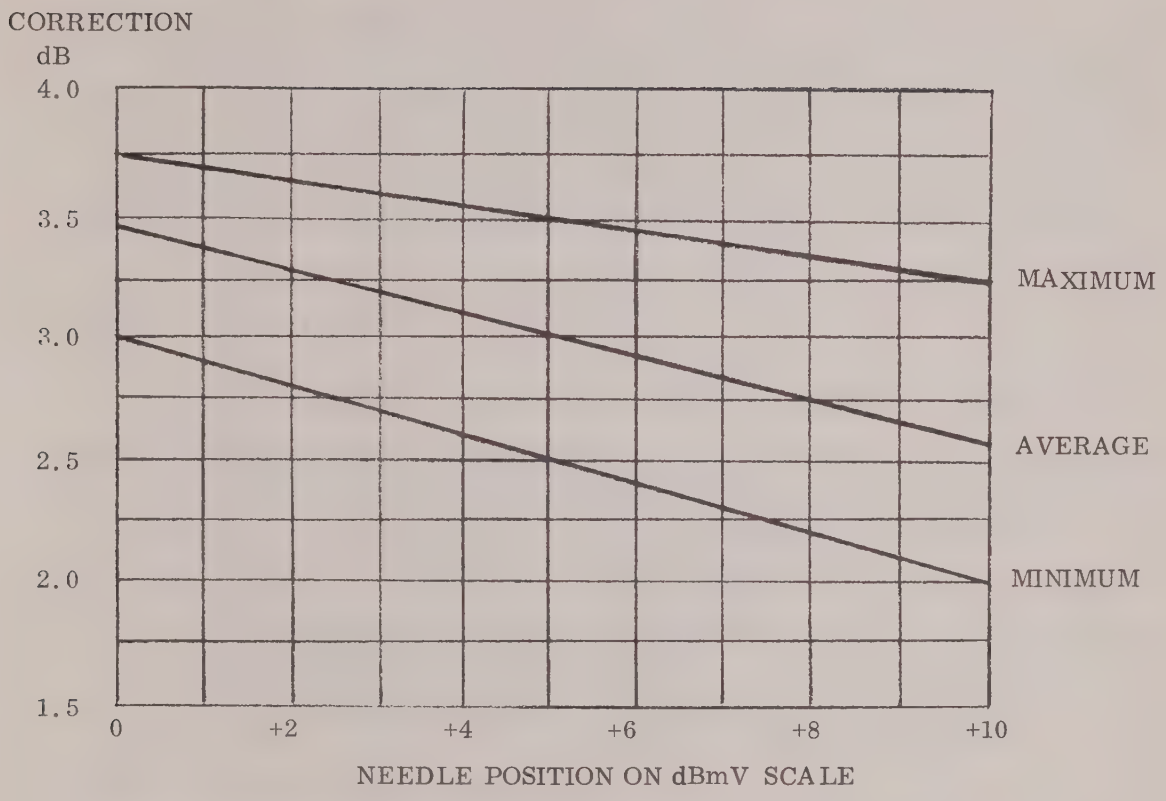
Then : a. Tune the 727 and the signal generator to the test frequency.
b. Measure and record the signal level at the input to the circuit under test.
c. Measure and record the signal level at the output of the circuit under test.
d. The gain or loss is the difference between the two readings obtained.

Example: If the input signal level is 5 dBmV and the output signal level is 1 dBmV, the circuit has a loss of 4 dB. If the output level is 40 dBmV for an input level of 5 dBmV, the circuit has a gain of 35 dB.

Readings are obtained at a number of points across the passband of the circuit and the results are plotted to obtain an approximation of the response curve.

5. MEASUREMENT OF NOISE LEVELS

Although the 727 meter scale is not calibrated for noise level readings, with proper correction of readings taken, the instrument can be used for measuring noise levels in CATV systems. The corrections are necessary for the following reasons:
Since noise levels in CATV systems are usually specified for a bandwidth of 4 MHz while the i-f bandwidth of the 727 is only 0.6 MHz, the meter readings would be about 8 dB low (noise power is proportional to bandwidth, hence a power ratio of 4 : 0.6 equals 6.7 which corresponds to 8.2 dB).
The second error source, having an effect opposite to that above, is the response to noise of the peak detector in the 727. Since the detector is designed to respond to the peak of the television picture signal, the instrument indicates peak noise rather than rms noise. As noise has a higher peak-to-rms ratio than a cw signal, the detected output reads high, reducing the correction required.



To obtain noise levels for 4-MHz bandwidth:

a. Measure noise level as if it were signal level.
b. To meter reading add the average correction shown opposite needle position.

Fig. 2 CORRECTION CURVES FOR NOISE LEVEL MEASUREMENTS

However, at reduced output levels the efficiency of the detector decreases and the detected noise reading is closer to rms; hence more total correction is needed for readings taken at the low end of the meter scale.

With these considerations in mind, noise calibration tests were made on a number of Models 727 chosen at random. The resulting correction curves are shown in Fig. 2. The curves indicate the maximum and minimum corrections found necessary for the tested units and the resultant average curve. The latter is sufficient for corrections of noise level measurements where an accuracy of plus or minus 0.75 dB is acceptable. For greater accuracy, the individual instrument would have to be calibrated on an accurately known noise source. (see para 6 below.)

For using the average curve in determining, for example, the S/N ratio in a trunk line, proceed as follows:

a. Connect the output of the last trunk line amplifier to the VHF INPUT terminal at the 727.
b. Disconnect the head-end output from the input to the first amplifier in the trunk line except the standby carrier signal which is needed for normal AGC operation.
c. Tune the 727 to the highest and the lowest channel carried on the system and record the meter readings as if a signal were measured.
d. Obtain the correct noise levels for both channels by adding the corrections taken from the average curve; or, for greater accuracy, from the noise calibration record of the particular Model 727.
e. Subtract the corrected noise levels from the signal levels of both channels at the output of the last amplifier to obtain the S/N ratio at that point.

6. NOISE CALIBRATION OF A MODEL 727

This section describes a convenient method of calibrating a 727 by using an amplifier whose noise figure is accurately known. Fig. 3 shows the equipment set-up. The input to the amplifier with known noise figure is terminated accurately in 75 ohms and its output is connected through a variable attenuator to the input of a second amplifier. The output of the latter is then connected to the VHF INPUT terminal of the field strength meter.

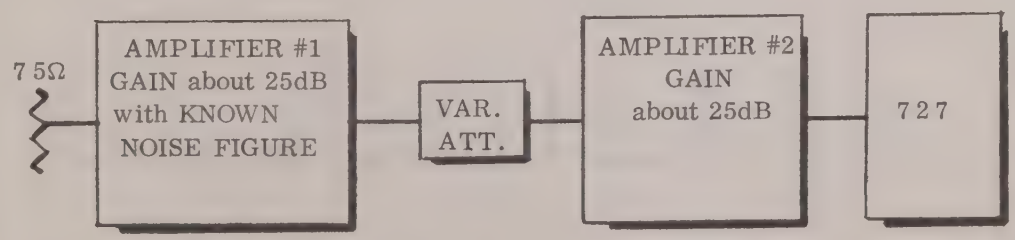


Fig. 3 Equipment set-up for Noise Calibration of a 727.

Calibration is made as follows:

a. Tune the 727 to a convenient channel having no local signal. Set the 727 step attenuator to 10 dB for a full-scale indication of -10 dBmV (0.3 mV) then adjust the tuner compensator to the calibrated point.
b. Adjust the variable attenuator until you get a full-scale reading on the meter.
c. Now measure the gain from the input to the first amplifier to the output of the second amplifier, then measure the noise figure at the input of the first amplifier. If the net gain from the input of the first amplifier to the input of the second amplifier is over 15 dB, it is safe to assume that the noise figure of the combination is the same as that of the first amplifier.
d. As the noise level in any 75-ohm system is -59.2 dBmV, the noise output of the combination into the field strength meter is: -59.2 + N.F. + Gain. If, for example, the noise figure measured were 8.4 dB and the net gain measured were 44.5 dB, the noise output of the combination would be: -59.2+44.5+8.4 = -6.3dBmV.
e. The correction for the 727 at full scale is the number of dB that must be added to the reading to equal this calculated noise level. In our example: -6.3 = -10 + X, and X = 10 - 6.3 = 3.7 dB.
f. Find the corrections required at other points of the scale by adding attenuation in 1-dB steps, noting after each step how far below the dB marks the meter needle reads.

7. MEASUREMENT OF PERCENT CROSS-MODULATION

Model 727 can be employed in a simple test set-up for making reasonably accurate percent cross-modulation measurements in the field, using the signals available in a TV distribution system. While the method described here is sensitive enough for measurements in an operating distribution amplifier, it is not sensitive enough for measurements in individual trunk line amplifiers operating at their normal system levels.

Fig. 4 shows the equipment set-up. The required signals are obtained from the system or directly from the head-end converters (for example from Channel Commanders). The c-w signal is obtained from a c-w generator or from the standby carrier condition of the converter concerned.

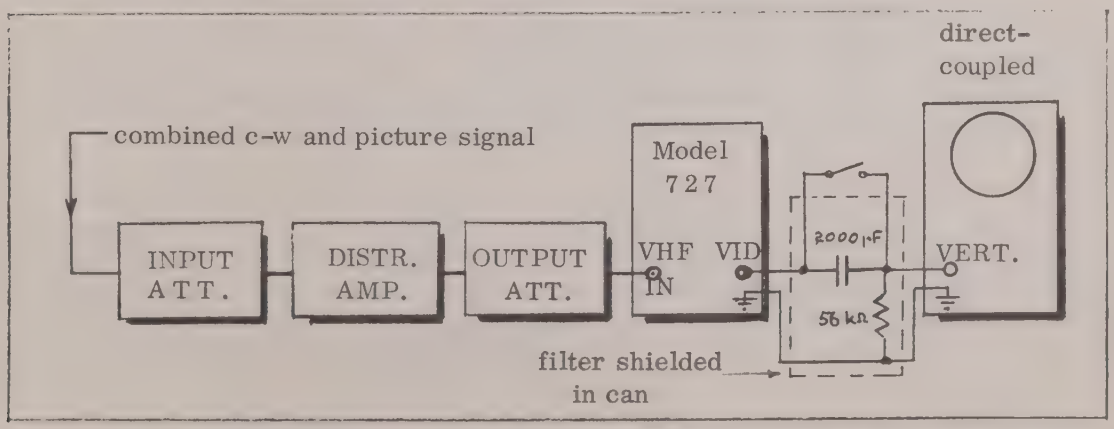


Fig. 4 Equipment set-up for Percent Cross-Modulation Measurement

To obtain meaningful results, modulation on all channels other than the one under test should be synchronous. Where tunable converters are used, this can be accomplished by tuning them all to receive the same channel.

The high-pass filter in the set-up passes any cross-modulation components (around 15 kHz) but blocks hum components (around 60 Hz) so that the latter will not ob - scure the measurement of cross-modulation. Operating the 727 on battery power will eliminate one possible source of hum contribution.

Measurement is done as follows:

a. Introduce the c-w signal on one channel, and interfering signals on other channels as required, through the input attenuator to the input terminal of the distribution amplifier, or the first trunk line amplifier of the system under test.
b. Connect the 727 through a second attenuator to the output of the distribution amplifier. or the last trunk line amplifier of the system; set the channel levels and the input attenuator to give rated output on each channel; note the meter reading.
c. Tune the 727 to the c-w signal frequency. Reduce the attenuation in the output attenuator by 20 dB and set the 727 manual gain control to obtain the same meter reading as in step b.
d. Close the filter bridging switch. Set the oscilloscope for operation in the d.c. mode and in the 0.1V/cm vertical sensitivity range. Position the reference trace on the bottom line of the oscilloscope screen and increase the input to the 727 by reducing attenuation in the output attenuator until reference signal and c-w signal differ by 0.8 V; the 727 manual gain control can be used for fine adjustment.
e. Switch the oscilloscope to the next higher sensitivity range and adjust the oscilloscope gain until the c-w trace is 10 divisions above the reference trace; each division now represents 10% cross-modulation.
f. Open the filter bridging switch and change the oscilloscope to a.c. operation, increase the vertical sensitivity 10 times; one division on the screen now represents 1% cross-modulation. The c-w trace can now be observed for exhibiting any modulation due to the presence of other channels in the system.

With one interfering channel, or when all interfering channels have a common sync source, the indicated cross-modulation will vary somewhat with the degree of white in the interfering picture signal. Exact percentage of cross-modulation is therefore determined by observing the oscilloscope until a maximum of cross-modulation is seen; this will occur when there is maximum variation in the interfering signal.

When the interfering signals derive their sync from various sources, their horizontal line frequencies will differ slightly so that relative timing of the various horizontal sync pulses will change constantly. In this case, maximum cross-modulation will occur when a number of sync pulses coincide; it will be necessary to observe the oscilloscope for a longer period to see this happen and to arrive at a reasonably exact percent cross-modulation corresponding to this condition.

To be sure that there is no cross-modulation in the 727 circuits or in the mixing networks in which the various input signals are combined, it is advisable to test for cross-modulation first without the amplifier or system in the circuit. Adjust for equal levels at the 727 input, tune to the c-w signal and then measure for cross - modulation as above.

Note: The video output of the 727 is specified at 0.8 volt p-p at full-scale meter indication. When using an oscilloscope with a sensitivity of 1 mV/cm, the gain can generally be increased up to 25 times for a maximum sensitivity of 0.4% cross-modulation per division.

When picture signals are not available, the signals from laboratory signal gen - erators with sine-wave modulation can be used for measuring cross-modulation. Because of the different form of modulation, corrections must be made if the re - sults of this measurement method are to agree with those obtained when using television signals.

Table 3 lists the corrections to be applied * and Fig. 5 diagrams the test set-up.

TABLE 3

On Interfering Signal		To Obtain Cross-Mod. Corresponding to TV Signal Modulation :	
% Modulation (for symmetrical Mod.)	Modulation Ratio ($\frac{E\ min}{E\ max}$)	Multiply Indicated % Cross-Mod. by :	or Add dB to Indicated Cross-Mod.
10	0.818	2.97	9.5
20	0.666	1.77	4.9
30	0.538	1.39	2.9
40	0.429	1.21	1.7
50	0.333	1.11	0.9
60	0.250	1.06	0.5
70	0.177	1.02	0.2
77.8 **	0.125	1.00	0.0
80	0.111	1.00	0.0
90	0.053	0.99	-0.1
100	0.000	0.99	-0.1

* The derivation of the correction figures is explained in TECHNICAL HANDBOOK FOR CATV SYSTEMS by Ken Simons. Copies are available from Jerrold's CATV Systems Division , Price $2.00 per copy.

** Corresponding to full modulation of a TV signal.

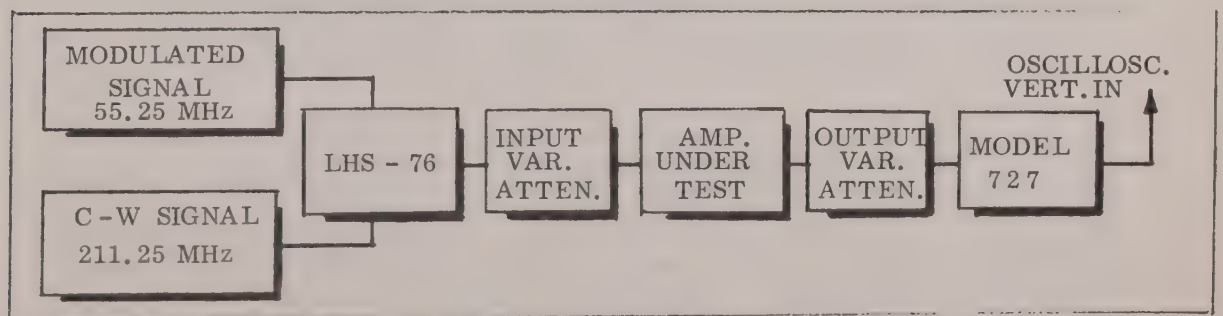


Fig. 5 TEST SET-UP FOR CROSS-MODULATION MEASUREMENT WHEN USING SIGNAL GENERATORS WITH SINE-WAVE MODULATION .

Test Procedure:

a. Tune one signal generator to the picture carrier (55.25 MHz) of channel 2, the other to that (211.25 MHz) of channel 13.
b. Combine the outputs of the two generators in a Jerrold Model LHS-76 high-band/ low-band mixer to prevent cross-modulation between the two bands.
c. Apply the LHS-76 output to the input of a variable attenuator, the output of this attenuator to the input of the amplifier under test, the output of the amplifier to the input of a second variable attenuator and the output of this attenuator to the VHF INPUT terminal on the 727; finally the VIDEO OUT terminal of the 727 is connected to the vertical input of the oscilloscope.
d. Preferably use the 727 on internal battery power to avoid hum pick-up. If the instrument has to be used on 117 V power, use a 2-pin adapter on the 727 line cord plug.
e. Set the oscilloscope to operate in the d-c mode.
f. Apply a modulation of 1 kHz to the 55.25 MHz signal, then set the input attenuator for 10 dB and the output attenuator for 20 dB.
g. Adjust the generator outputs for rated output levels of the amplifier at both frequencies, taking into consideration the attenuation in the output attenuator.
h. Disconnect the oscilloscope input signal and set the oscilloscope vertical sensitivity and centering controls so that 0 signal reference is on the bottom line of the screen.
i. Reconnect the oscilloscope input signal and tune the 727 to the modulated signal (55.25 MHz); then adjust the oscilloscope vertical gain control so that the top of signal trace is at the top of the screen (an oscilloscope with a 10 cm grid is assumed).
k. Select a convenient percent modulation figure from Table 3, e.g. 30%. Adjust the modulation control on the 55.25 MHz generator so that the bottom of the signal trace is 5.4 divisions (for 30% modulation) above the reference trace, while keeping the top of the signal at the 10th division by adjusting the oscilloscope vertical gain control.
l. Maintain the generator output levels as in step g while adjusting the modulation control on the 55.25 MHz generator. Then remove 20 dB from the 727 step attenuator, pull the 727 TUNER COMP/MAN GAIN control to the MAN GAIN position and set it for the same meter reading as in step g.
m. Set the oscilloscope vertical sensitivity to the calibrated 0.1V/cm range, remove the oscilloscope input signal and reset the vertical centering to place the 0 signal reference on the bottom line of the screen. Then reconnect the oscilloscope input signal.
n. Remove attenuation from the output attenuator until the 727 video output reads 0.8V on the oscilloscope; fine adjustment can be made with the 727 MAN GAIN control.
o. Switch the oscilloscope to the next higher gain range and check for modulation as in step k. If the modulation is not the same as in step k, push the 727 TUNER COMP/ MAN GAIN control to the TUNER COMP position and repeat the procedure from step g onwards.
p. With the 727 video output at 0.8 V peak modulation level, adjust the oscilloscope vertical sensitivity so that the top of the signal trace is on the 10th division of the screen; each major screen division now represents 10% apparent cross-modulation.
q. Switch the oscilloscope to operate in the a.c. mode and increase vertical sensitivity 10 times; each major screen division now represents 1% apparent cross-modulation.
r. Tune the 727 to the c-w signal frequency (211.25 MHz) ; since the 727 meter will now read off scale, tune for maximum deflection of the oscilloscope display.

s. Obtain true percent cross-modulation by multiplying the measured apparent cross-modulation by the correction factor for the percent modulation of the interfering (modulated) signal. Hence, for our example true percent cross-modulation is 0.8% x 1.39 = 1.1 %.

8. MEASUREMENT OF HUM MODULATION

Since most r-f amplifiers are powered with 60 Hz a.c., the possibility exists that power supply ripple will modulate the signal passing through the amplifier. To measure this type of modulation with the 727 proceed as follows:

a. Connect the equipment as diagrammed in Fig.6. Use a General Radio Type 274-MB twin banana plug at the vertical input of the oscilloscope and insert a 20,000 pF capacitor between the input and the oscilloscope chassis ground for filtering out noise. Also, to minimize stray hum loops, be certain that there is no ground connection to the oscilloscope chassis other than the input cable shield. If the oscilloscope has a 3-pin plug on its line cord, attach a 2-pin adapter. Operate the 727 on battery power, eliminating the possibility of the 727 itself contributing hum.
b. Sync the oscilloscope to the line frequency, then tune the generator and the 727 to a convenient frequency; the center of the amplifier pass band is a good choice.
c. Set the oscilloscope to d.c.coupling and the 0.1 V/cm range. Adjust the input to the amplifier or system under test so that the output is at normal operating level, keeping a minimum of 10 dB in the 727 step attenuator.
d. Remove 20 dB from the output attenuator, then pull the TUNER COMP/MAN GAIN control to the MAN GAIN position set it for the same meter reading as in step c.
e. Remove the oscilloscope input signal and adjust vertical centering so that the 0 signal trace is displayed on the bottom line of the screen.
f. Reconnect the oscilloscope input signal and remove attenuation from the output attenuator until the trace of the modulated signal is 8 divisions above the reference trace, indictaing 0.8 V (assuming a 10 cm grid on the screen); fine adjustment can be made with the 727 MAN GAIN control. If appreciable modulation is present, center the trace on the 8th grid line.
g. Switch the oscilloscope vertical sensitivity to the next higher range and remove the oscilloscope input signal. Then adjust vertical centering to reset the 0 signal trace on the bottom line of the screen.
h. Reconnect the oscilloscope input signal and adjust the oscilloscope gain until the modulated signal trace is centered on the 10th grid line. Then set the oscilloscope for a.c.coupling and center the trace for convenient measurement of the peak-to-peak amplitude. Each major division on the screen now represents 5% modulation (or 26 dB down from a 100% modulated signal), since a 5% modulated signal has a 5% excursion in both directions from its zero modulation level.

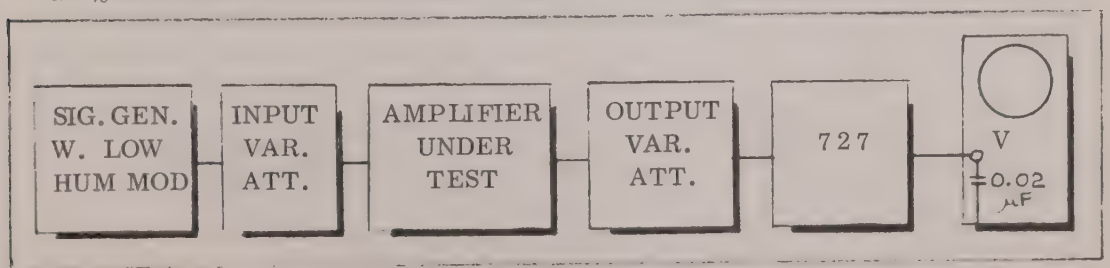


Fig. 6 TEST SET-UP FOR MEASURING HUM MODULATION

i. For example, if the peak-to-peak amplitude of the trace covers 1.5 major screen divisions, the hum modulation is 1.5 x 5% = 7.5 % (or 22.5 dB down from a 100% modulated signal).

k. If the modulation is less than 5%, increase the oscilloscope vertical sensitivity 10 times; each major division on the screen now represents 0.5% modulation (or 46 dB down from a 100% modulated signal). By a further increase of 5 times, modulation as low as 0.1 % can be displayed on the screen.

9. MEASUREMENT OF SYNC CLIPPING

The normal sync signal accounts for approximately 25% of the total amplitude of a composite television video signal. Determining whether or not an amplifier or system of amplifiers is clipping the sync signal can be done with the 727 as follows:

a. Connect the equipment as diagrammed in Fig. 7.
b. Tune the 727 to the video carrier of a t.v. channel and adjust the amplifier or system for normal operational output.
c. Set the oscilloscope for d.c. coupling and vertical sensitivity to calibrated 0.1V/cm.
d. Increase the input to the 727 by removing attenuation from the input attenuator and by fine adjustment of the 727 MAN GAIN control until the meter reads the same as in step b.
e. Increase the signal input to the 727 by adjusting the input attenuator until the sync pulse tips are 8 divisions above the reference trace, corresponding to 0.8 V.
f. Insert 2.5 dB in the input attenuator and note the position of the sync tip on the screen; it represents 25% amplitude.
g. Set the input attenuator to 0 dB and observe the position of the sync pedestal back porch on the screen. If the back porch falls appreciably above the line noted in step f, the sync signal has been compressed.

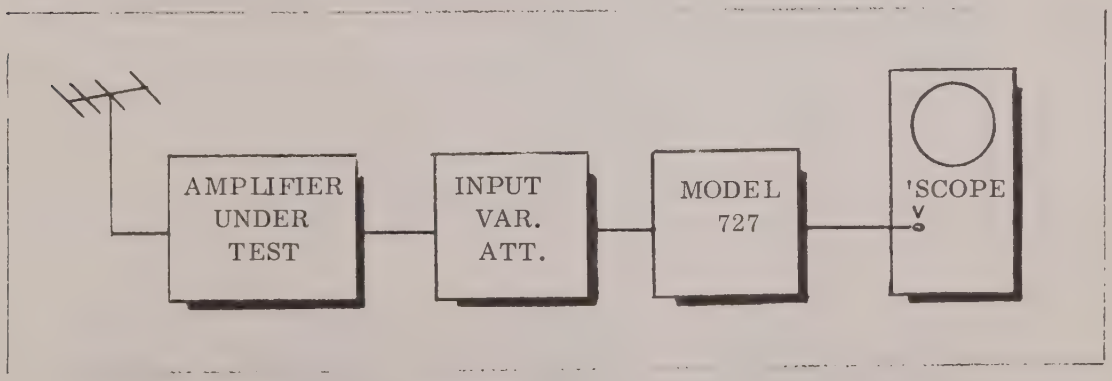


Fig. 7 TEST SET-UP FOR MEASURING SYNC CLIPPING

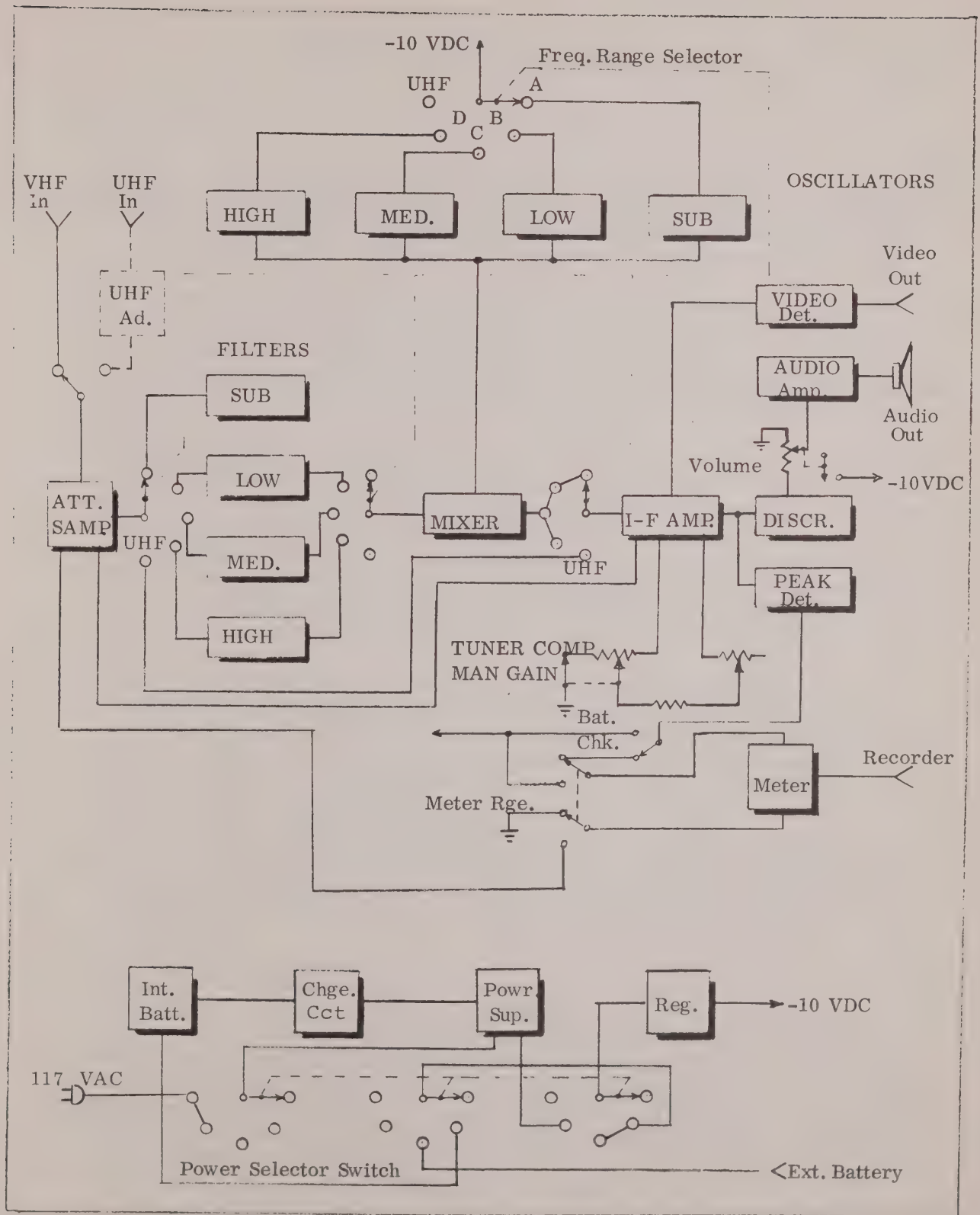


Fig. 8 Model 727 Functional Block Diagram

CIRCUIT DESCRIPTION

1.0 GENERAL

1.1 Fig. 8 is a functional block diagram of the Model 727 circuit stages.

1.2 The signal to be measured is applied to the front panel VHF INPUT terminal. With the UHF/VHF switch in the VHF position, the signal passes through the switch contacts to a multi-step attenuator which serves to adjust the measurement range of the unit.

1.3 From the attenuator the signal passes through one of four bandpass filters, selected by the frequency range selector switch. The signal is then applied to a balanced mixer circuit where it beats with the signal from one of the tuner oscillators to give the i-f signal. The tuner assembly consists of four oscillators, one four each tuning range. The appropriate oscillator is energized through the frequency range selector switch.

1.4 The mixer output is applied through contacts of the frequency range selector switch to the i-f amplifier. The input and the output of the first amplifier stage are sharply tuned with 52 MHz coaxial resonator bandpass filters. The signal is passed through two additional amplification stages and then takes two paths.

1.5 Part of the signal is amplified, detected, and then fed to the front panel VIDEO OUTPUT terminal. The other portion of the signal is detected by a phase discriminator and then amplified to drive a small panel-mounted speaker. A-m as well as f-m signals pass through the discriminator so that sync buzz and intelligible a-m transmissions can be heard.

1.6 The signal at the input of the discriminator is also fed to a peak detector circuit. The detected signal drives the 727 meter and is brought out to a rear panel phone jack for application to a recording device if desired. The COMP control in the i-f amplifier calibrates the unit across its frequency range, when in the pushed-in position, and acts as a manual gain control for sync compression and hum measurements when in the pulled-out position.

1.7 The 727 may be powered from its own rechargeable 12 V battery, from an external 12-15 V battery, or from a 117 V a-c line. The power source is selected with a front panel switch which also provides for recharging the internal battery at a 10% rate from the 117 V line; the battery is trickle-charged while the unit is operating from the line.

2.0 ATTENUATOR (see DWG. 861-829)

2.1 The v.h.f. input signal is applied through the VHF INPUT terminal J101 and the UHF/VHF switch S101 to the attenuator. The attenuator consists of one 10-dB pad and four 20-dB pads switched into or out of the signal path by switches S102 through S106, thus giving the attenuator a range of 0 - 90 dB in 10-dB steps. The attenuator settings determine the level of the signal applied to the measuring circuit and thus the measurement range of the unit.

2.2 In addition, the step attenuator with its built-in sampling network operates in conjunction with the METER RANGE switch S4 to provide an indication on the meter of the measurement range for which it is set. When S4 is pressed, -10 V is applied across the meter M1 and the sampling network in the attenuator. The deflection of M1 is then determined by the attenuator setting so that the measurement range is indicated by the position of the meter needle on the meter range scale.

2.3 The signal from the attenuator is applied through contacts of the frequency range selector switch S701 to one of four bandpass filters.

3.0 BANDPASS FILTERS (see DWG. 861-829)

3.1 The 727 employs four bandpass filters, one for each of the v.h.f. tuning ranges. Selection of one of the filters is done by setting the frequency range selector switch S701 which passes the output signal of the selected filter through J801 on to the mixer.

4.0 VHF TUNER (see DWG. 861-779)

4.1 The v.h.f. tuner consists of four permeability-tuned Colpitts oscillators, one for each tuning range. They are energized by -10 V applied through contacts of S701. The oscillators operate at 52 MHz above the associated tuning frequency to give a 52 MHz i-f signal at the mixer.

4.2 Oscillator tuning is accomplished by changing the position of the iron cores in L402, L405, L408, and L411. The cores are mounted on a bracket and are moved through the coils by a rack and pinion mechanism. The cores are attached to flexible, threaded shafts, which permit individual adjustment of each core and compensate for any misalignment between the core mounting bracket and the coils.

4.3 Each oscillator has three alignment adjustments: trimmers C405, C412, C419, and C425 tune the low-frequency ends of the oscillator ranges; coils L403, L406, L409, and L412 adjust the high-frequency ends; coils L402, L405, L408, and L411 also serve to adjust scale tracking.

4.4 The oscillator output signals are coupled through C406, C413, C420, and C426 to a common feed-through on the mixer module.

5.0 MIXER (for this and all following circuit stages see DWG. 861-829)

5.1 The signals from the bandpass filters and the v.h.f. tuner are transformer-coupled to a balanced mixer employing diodes CR801, CR802, CR803, and CR804 where they beat to give the 52 MHz i-f signal. The mixer output is coupled to J802 and from there through J201 to the i-f amplifier.

6.0 I-F AMPLIFIER

6.1 The i-f amplifier input signal is applied to a low-pass filter consisting of L201, L202, L203, C201, and C202, which provides input match and attenuates unwanted signals above 52 MHz. From the input circuit the signal is passed through a 52 MHz coaxial resonator filter to the first amplifier stage employing Q201 in a neutralized, common-emitter, singled-tuned circuit. Neutralization is controlled by trimmer C207; tuning is accomplished through trimmer C211. The amplified signal is coupled to another 52 MHz coaxial resonator filter. It is the bandwidth

of these two filters that chiefly determines the bandwidth and adjacent-channel rejection of the i-f stages.

6.2 The signal from the second filter is amplified by two common-base, single-tuned stages Q202 and Q203. Tuning is accomplished through L214 and L215 respectively. The input level at Q203 is adjusted with potentiometer R238 and the COMP control R210/S201. With the COMP knob pushed in, S201 is open and the control acts with R238 to calibrate the 727 over its operating frequency range by adjusting the gain of the i-f amplifier at specific frequencies across the range. With the knob pulled out, S201 is closed and the COMP control functions as an uncalibrated gain control.

6.3 The output of Q203 is coupled to Q205 in the video detector circuit and to Q204 in the discriminator circuit.

7.0 VIDEO DETECTOR

7.1 The signal from the i-f stages is amplified by Q205 and coupled to the video detector CR201. The detected signal is coupled to J204 and then, through a jumper, to the VIDEO OUTPUT terminal J5. The amplifier stage Q205 is tuned to 52 MHz through L218.

8.0 DISCRIMINATOR

8.1 The other portion of the i-f signal is amplified by Q204 and coupled to discriminator CR202/CR203 where the f-m signals are detected. The amplifier output is tuned through the primary, L216-A, of the discriminator transformer.

8.2 The audio signal developed by the discriminator is fed through J205 and P205 to an audio amplifier. The undetected output of Q204 is coupled through C224 to a peak detector.

9.0 AUDIO AMPLIFIER

9.1 The audio amplifier input signal is applied across VOLUME control R7. The audio signal is passed through four stages of amplification, including the push-pull output stage which drives the panel-mounted speaker. The amplifier is energized through switch S6 mounted on the volume control shaft.

10.0 PEAK DETECTOR

10.1 The undetected signal from Q204 is amplified by Q206 and coupled through C236 to a peak detector/current amplifier Q207/Q208. Meter M1 is made part of the collector circuit of Q208 through J205, P205, S5, and S4 so that it indicates the current passing through the transistor. Resistor R237 limits the maximum overload current through the meter to 100 percent. Potentiometer R234 determines the current through the meter with no input signal to the 727 and thereby determines the meter calibration. Diodes CR204 and CR205 compensate for changes in current through the detector caused by temperature variations. The current through M1 is made available at jack J1 for operation of a recording device.

11.0 POWER SUPPLY

11.1 Power for the 727 may be selected by switch S1 for one of three sources as explained in para 1.7.

11.2 With S1 in INT BATT position, the negative terminal of the internal battery is connected through the interlock switch S3 and contacts of S1 to the DIAL LIGHTS switch S2 and regulator Q601, Q602, and Q603. Potentiometer R604 in the regulator circuit sets the supply output at -10 V. The interlock switch helps to prevent accidental discharge or overcharge of the internal battery when the panel cover is closed.

11.3 In the EXT BATT position, S1 connects the negative terminal of the external battery to S2 and to the regulator. The external battery connections are made at J3 (positive terminal) and J4 (negative terminal) at the rear of the 727.

11.4 With S1 in the AC position, the primary circuit of transformer T1 is complete, and the voltage generated across the secondary is applied to the full-wave rectifier CR601, CR602. The rectified voltage is filtered by C603 and applied through contacts of S1 to the regulator. In addition, the unregulated -18 V at the junction of CR601 and CR602 is coupled through CR1, R2, and S3 to the negative terminal of the internal battery to trickle-charge the battery. The AC lamp DS1 indicates that the unit is under power from the 117 V line.

11.5 The fourth position of S1, CHG, is provided to permit charging the internal battery. The contacts of S1 apply -18 V to the battery through the CHARGE lamp DS2, and through R3 and S3.

MAINTENANCE

1.0 GENERAL

1.1 This section contains procedures for minor realignment of the i-f section and for recalibrating the instrument. In addition, a replacement parts list and schematic diagrams are included as aids for the maintenance of the unit.

1.2 If for some reason repairs cannot be made in the field, the unit may be returned to Jerrold Electronics, Service Dept., 15th and Lehigh Ave., Philadelphia, Penna. After notifying Jerrold of your intention to return the unit for repair, carefully pack the unit and ship it (with freight and insurance prepaid) together with a note stating the serial number of the unit and listing the difficulties encountered. Repairs will be made free of charge under conditions of the warranty; otherwise nominal charges will be invoiced.

1.3 Because alignment of the tuner requires special test fixtures, the procedure for this module is not given here. If the tuner requires realignment or if the i-f section becomes grossly misaligned, the 727 should be returned to Jerrold for realignment.

1.4 Recalibration should be performed routinely at six-month inervals or when the calibration is suspect. The i-f section should be realigned whenever a transistor is replaced.

2.0 CALIBRATION

2.1 EQUIPMENT REQUIRED

2.2 The equipment required to calibrate Model 727 is listed below. A discussion of the requirements of the equipment follows the list.

a. An r-f signal generator
b. A power meter, Hewlett-Packard Model 431A or B,with Model 478A thermistor mount
c. A 6-dB splitter, Jerrold Model 1502
d. One or two 50/75-ohm minimum loss pads, Jerrold Model MLP 50/75F, or two matching pads (see Fig. 9)
e. A vacuum-tube voltmeter

2.3 A good quality r-f signal generator with a calibrated output attenuator is required for calibrating the 727. Generators that meet these requirements include: General Radio Model 1021-AV, Measurements Model 80, Hewlett-Packard Model 608A, and Boonton Radio Model 202B.

2.4 The preferred "power meter" method uses a Hewlett-Packard Model 431A or B power meter with a Model 478A thermistor mount and the 6-dB splitter.

2.5 For accurate calibration it is important that the output impedance of the signal generator be 75 ohm. Where an r-f signal generator with an output impedance of 50 ohm is used, a 50/75-ohm minimum loss pad must be inserted between the generator and the splitter (see Fig. 10). As the input impedance of the HP power meter is 50 ohm , a similar minimum loss pad is required for the power meter method. Fixed 7.78 dB matching pads may be used in place of the minimum loss pads, bearing in mind that the signal attenuation will differ. (The circuit for a "do-it-yourself" pad is given in Fig. 9). In the calibration procedure, wherever level settings depend on the type of pad employed, the settings for both types are given.

2.6 Furthermore, keep in mind that most r-f signal generators are calibrated working into an open circuit. When the generator is working into a matched load, the signal level at the load is half the level indicated at the generator (see Table 4).

TABLE 4

dB in 727 Att.	GENERATOR OUTPUT*				FULL SCALE 727 METER READINGS
	MATCHED 75 - OHM	UNMATCHED 75 - OHM	MATCHED 50 - OHM	UNMATCHED 50 - OHM	
10	300 uV	600 uV	600 uV	1200 uV	300
20	1000 uV	2000 uV	2000 uV	4000 uV	100
30	3000 uV	6000 uV	6000 uV	12 mV	300
40	10 mV	20 mV	20 mV	40 mV	100
50	30 mV	60 mV	60 mV	120 mV	300
60	100 mV	200 mV	200 mV	400 mV	100
70	300 mV	600 mV	600 mV	1.2 V	300
80	1.0 V	2.0 V	2.0 V	4.0 V	100
90	3.0 V	6.0 V	6.0 V	12.0 V	300

* a. If a model MLP (5.7 dB) is used instead of a 7.78 dB pad, the voltage listed for 50-ohm output must be multiplied by 0.785 for the appropriate full scale readings.

b. For the UHF position of meter range switch, all tabulated voltages must be multiplied by 0.355. If a model MLP (5.7 dB) pad is used instead of a 7.78 pad, all voltages listed for 50-ohm output must be multiplied by 0.279.

2.7 SETTING THE REGULATED VOLTAGE LEVEL

2.7.1 Open the line cord compartment and remove the cord.

2.7.2 Remove the four screws at the rear of the cabinet.

2.7.3 Slide the chassis out through the front of the cabinet.

2.7.4 Set the power selector switch to INT BATT (be certain that the battery is fully charged).

2.7.5 Connect the vtvm between the hot terminal of the VOLUME control and ground. If necessary, adjust R604 on the power supply so that the meter reads -9.9 to -10.0 V.

2.7.6 Press the BATT CHECK switch and see that the meter needle points to the red BATT mark.

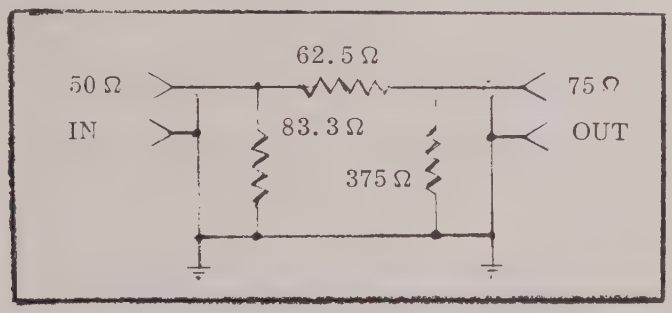


Fig. 9 Circuit of 7.78 dB Pad

2.8 TUNER COMPENSATOR CALIBRATION (POWER METER METHOD)

2.8.1 Power the 727 from the 117 V line.

Use 36.5MV For IF
100MV Thru RCVR

2.8.2 Set the power selector switch to AC.

2.8.3 Set the UHF/VHF switch to VHF.

2.8.4 Set the frequency range switch to UHF.

2.8.5 Push in the COMP control and set it to 7.

2.8.6 Switch 60 dB into the 727 attenuator.

2.8.7 Connect equipment as shown in Fig. 10.

2.8.8 Tune the signal generator to 52 MHz ; the 727 meter should show maximum deflection.

2.8.9 Adjust the generator output level to give a power meter reading of -13.43 dBm (-15.51 dBm when using 7.78 dB pads)

(~~-7.43 Direct~~)

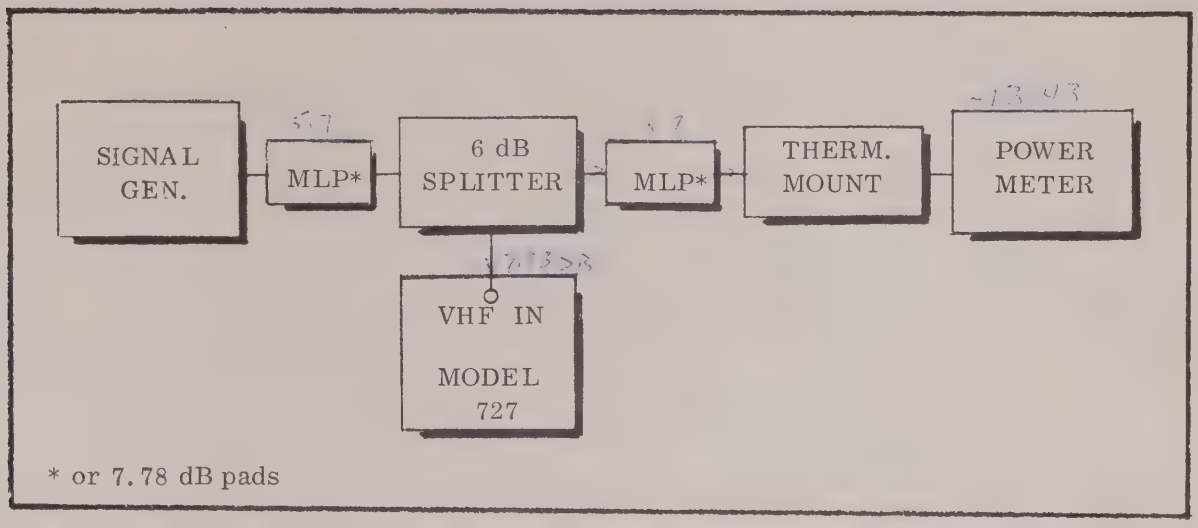


Fig. 10 Setup for Tuner Compensator Calibration by the Power Meter Method

2.8.10 Adjust R238 on the i-f chassis for full-scale deflection on the 727 meter; this adjustment is made with a small screwdriver inserted through the hole in the i-f chassis bottom cover.

2.8.11 Increase the 727 attenuator setting by 10 dB and than 10 dB more, observing that the meter reads first 0 and then -10 dB on the dB scale.

2.8.12 If the meter reads off these marks, loosen the lock-nut on the zero-adjust control (R231 on the i-f chassis) and adjust it to bring the meter pointer toward these marks.

2.8.13 Return the 727 attenuator setting to 60 dB and readjust R238 for full scale meter deflection.

2.8.14 Repeat steps 2.8.11, 2.8.12, and 2.8.13 until best agreement is obtained between the meter pointer and the 0 and -10 dB marks; then tighten the lock-nut on R231.

2.8.15 Record the COMP control setting (7) next to UHF on the calibration chart.

2.8.16 Set the frequency range switch to B.

2.8.17 Tune the generator and the 727 to the center frequency of t.v. channel 2.

2.8.18 Adjust the COMP control for full-scale meter deflection while the power meter reads -4.43 dBm (-6.51 dBm if 7.78 dB pads are used); be certain that the generator is tuned for maximum deflection on the 727 meter.

At this point, repeat step 2.8.11, observing the meter readings. If there is a significant difference between these readings and those first obtained in step 2.8.11, readjust R231 for a compromise setting. Use the COMP control, not R238, for making full-scale adjustments.

If the setting of R231 is changed, it will be necessary to repeat steps 2.8.5 thru 2.8.10, 2.8.16, 2.8.17 and 2.8.18.

2.8.19 Record the COMP control setting next to CH 2 on the calibration chart.

2.8.20 Repeat steps 2.8.17, 2.8.18, and 2.8.19, tuning the 727 and the generator to all of the calibration points in the B, C, and D ranges.

2.8.21 Set the 727 frequency range switch to A.

2.8.22 If necessary, replace the signal generator with one that will cover this range.

2.8.23 Repeat steps 2.8.17, 2.8.18, and 2.8.19 for all A-range calibration points except 5 MHz.

2.8.24 Set the COMP control to the position determined for 10 MHz, and tune the 727 and the generator to 10 MHz.

2.8.25 Calibrate the generator and observe the setting of its attenuator when the 727 meter reads full scale.

2.8.26 Tune the 727 and the generator to 5 MHz.

2.8.28 Calibrate the generator and adjust its attenuator to the same reading as in step 2.8.25.

2.8.28 Adjust the COMP control for full-scale deflection in the 727 meter.

2.8.29 Record the control setting next to 5 MHz on the calibration chart.

2.8.30 Disconnect the line cord from the unit.

2.8.31 Return the chassis to the cabinet and fasten it with the four screws.

2.9 TUNER COMPENSATOR CALIBRATION (SIGNAL GENERATOR METHOD)

2.9.1 Power the 727 from the 117 V line.

2.9.2 Set the power selector switch to AC.

2.9.3 Set the UHF/VHF switch to UHF.

2.9.4 Set the frequency range switch to UHF.

2.9.5 Push in the COMP control and set it to the UHF check point COMP figure on the factory-supplied calibration chart.

2.9.6 Switch 40 dB into the 727 attenuator.

2.9.7 Connect equipment as shown in Fig. 11.

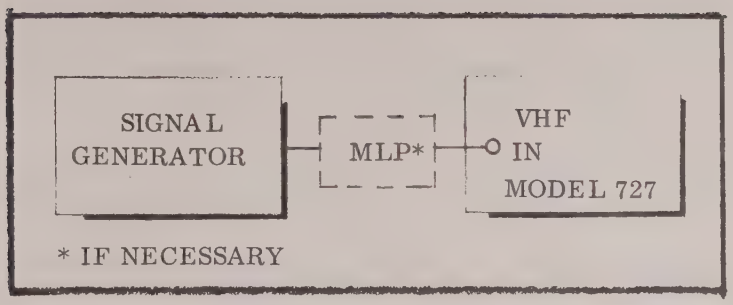


Fig. 11 Setup for Tuner Compensator Calibration by the Signal Generator Method

2.9.8 Tune the signal generator to 52 MHz; the 727 meter should show maximum deflection.

2.9.9 Calibrate the generator and set its output level at 0.355 times the level listed in Table 4 for 40 dB attenuation and the appropriate generator.

2.9.10 Adjust R238 on the i-f chassis for full-scale deflection on the 727 meter; this adjustment is made with a small screwdriver inserted through the hole in the i-f chassis bottom cover.

2.9.11 Increase the 727 attenuator setting by 10 dB and then 10 dB more, observing that the 727 meter reads first 0 and then -10 on the dB scale.

2.9.12 If the meter reads off these marks, loosen the lock-nut on the zero-adjust control (R231 on the i-f chassis) and adjust the control to bring the pointer toward these marks.

2.9.13 Return the 727 attenuator to 40 dB and readjust R238 for full-scale meter deflection.

2.9.14 Repeat steps 2.9.11, 2.9.12, and 2.9.13 until best agreement is obtained between the meter pointer and the 0 and -10 dB marks; then tighten the lock-nut on R231.

2.9.15 Record the COMP control setting next to UHF on the calibration chart.

2.9.16 Set the Frequency range switch to B.

2.9.17 Tune the generator and the 727 to the center frequency of t.v. channel 2.

2.9.18 Calibrate the generator and set its output at the level listed in Table 4 for 40 dB in the 727 attenuator.

2.9.19 Adjust the COMP control for full-scale meter deflection; be certain that the generator is tuned for maximum deflection on the meter.

At this point, repeat step 2.9.11, observing the meter readings. If there is a significant difference between these readings and those first obtained in step 2.9.11, readjust R231 for a compromise setting. Use the COMP control, not R238, for making full scale adjustments.

If the setting of R231 is changed, it will be necessary to repeat steps 2.9.4, 2.9.5, 2.9.6, 2.9.8, 2.9.9, 2.9.10, and 2.9.16 thru 2.9.19.

2.9.20 Record the COMP control setting next to CH 2 on the calibration chart.

2.9.21 Repeat steps 2.9.17 thru 2.9.20, tuning the generator and the 727 to all of the calibration points in the B, C, and D ranges.

2.9.22 Set the frequency range switch to A.

2.9.23 If necessary, replace the signal generator with one that will cover this range.

2.9.24 Repeat steps 2.9.17 thru 2.9.20 for all A-range calibration points.

2.9.25 Disconnect the line cord from the unit.

2.9.26 Return the chassis to the cabinet and fasten it with the four screws.

3.0 I-F SECTION ALIGNMENT

3.1 GENERAL

3.1.1 The need for realigning the i-f amplifier is indicated when,in attempting to calibrate the unit,it is noted that the COMP settings have moved appreciably toward the high end of the control range.

3.1.2 Complete realignment of the i-f amplifier requires test equipment not normally available in the field. For this reason, if the section is grossly misaligned, the unit should be returned to Jerrold for realignment. However, it is possible to perform minor realignment (or to determine if factory realignment is necessary) with satisfactory results by using relatively common items of test equipment. The procedure for this minor realignment is described below.

3.1.3 Note that two procedures for aligning the discriminator are also described. The first (sweep generator) method is the preferred one. After aligning the i-f amplifier, it will be necessary to align the discriminator and then calibrate the unit.

3.2 EQUIPMENT REQUIRED

3.2.1 An r-f sweep generator, Jerrold Model 900A or B or equivalent.

3.2.2 A crystal-calibrated marker generator, RCA Model WR-99A or equivalent.

3.2.3 A variable attenuator, Jerrold Model AV-75 or equivalent.

3.2.4 An oscilloscope

3.3 I-F AMPLIFIER ALIGNMENT

3.3.1 Open the line cord compartment and remove the cord.

3.3.2 Remove the four screws at the rear of the cabinet.

3.3.3 Slide the chassis out through the front of the cabinet.

3.3.4 Power the 727 from the 117 V line.

3.3.5 Set the power selector switch to AC.

3.3.6 Set the UHF/VHF switch to VHF.

3.3.7 Set the frequency range switch to UHF.

3.3.8 Switch 30 dB into the 727 attenuator.

3.3.9 Set up equipment as shown in Fig. 10; test point no. 2 is accessible through a hole in the chassis rear panel near the lower left corner.

3.3.10 Check that the index mark on the COMP control knob points to 10 when the control is in its maximum clockwise position; if it does not, loosen the setscrew and set the index mark on 10.

3.3.11 Push in the COMP control and set it at 7.

3.3.12 Set the marker and the sweep center frequency at 52 MHz.

3.3.13 Set the oscilloscope vertical sensitivity control for maximum gain. Use the variable attenuator for controlling the amplitude of the oscilloscope display.

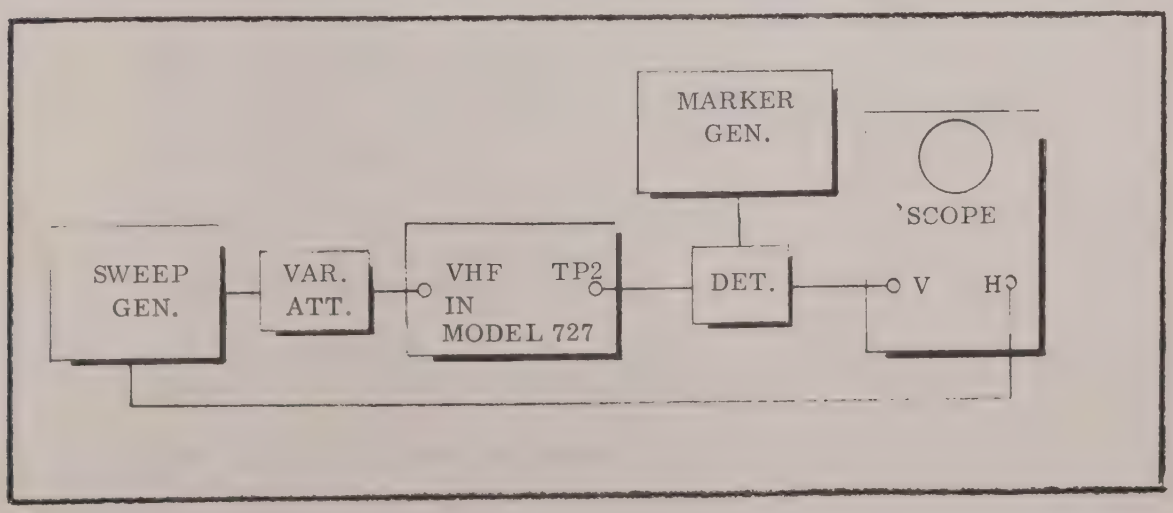


Fig. 12 Setup for I-F Amplifier Alignment

3.3.14 Adjust L214, L215, and C211 for maximum response at 52 MHz (Fig. 13). Use a hexagonal alignment tool similar to General Cement No. 8606 for the inductors and a Walsco No. 2519 tool for the trimmer.

Note: All adjustments are accessible through holes in the bottom cover of the i-f chassis.

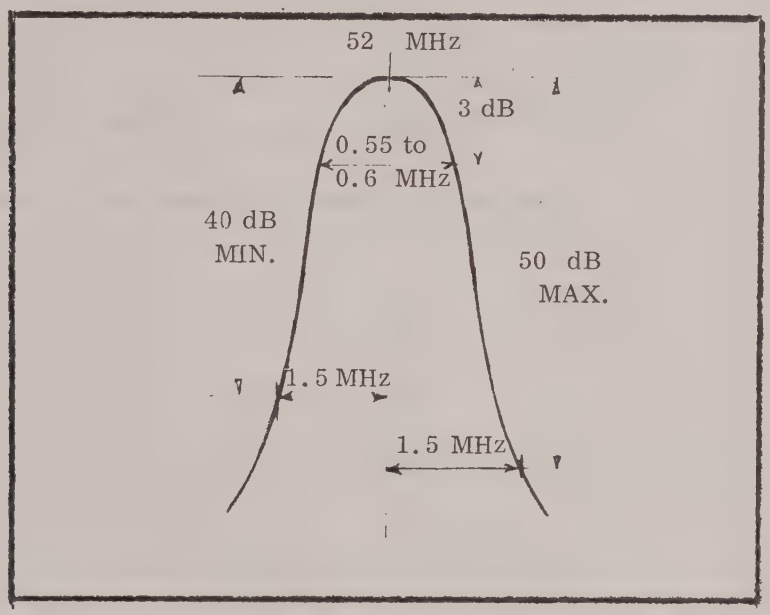


Fig. 13 Response of i-f Amplifier at Test Point No. 2

3.3.15 Trimmers C240/C241 and C242/C243 form double-tuned pairs, but the bandwidth of the i-f amplifier is so narrow that they too are tuned for maximum response at 52 MHz.

3.3.16 If a response similar to that shown in Fig. 13 cannot be obtained with the adjustments in steps 3.3.14 and 3.3.15, C201, C202, C205, and C214 may be adjusted; however, since these trimmers affect the input match of the amplifier, they should be disturbed only as a last resort. If one or more of these trimmers is obviously misaligned, adjust one at a time, being careful to return the adjustment screw to its original position if no improvement on the response is seen.

3.4 VIDEO AMPLIFIER/DETECTOR ALIGNMENT

3.4.1 Connect equipment as shown in Fig. 14.

3.4.2 Adjust the amplitude of the oscilloscope display with the variable attenuator, not with the oscilloscope vertical sensitivity control.

3.4.3 Adjust L218 for maximum response at 52 MHz.

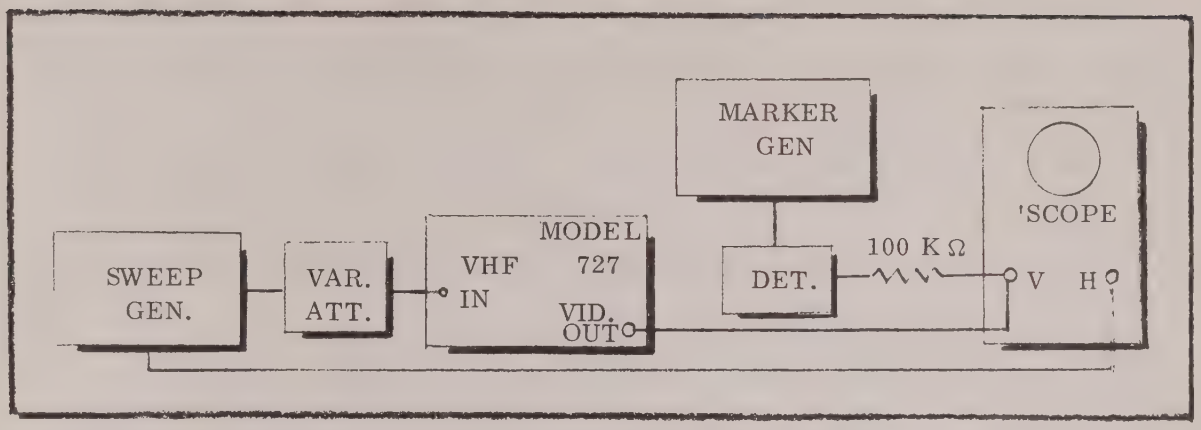


Fig. 14 Setup for Video Amplifier/Dectector Alignment

3.5 DISCRIMINATOR ALIGNMENT (SWEEP GENERATOR METHOD)

3.5.1 Connect equipment as shown in Fig. 15.

3.5.2 Set the sweep width as narrow as possible so that the generator output is essentially at one frequency.

3.5.3 Set the sweep center frequency at 52 MHz, as indicated by maximum deflection on the 727 meter.

3.5.4 Adjust the variable attenuator for a reading of 4 dB on the 727 meter.

3.5.5 The discriminator coil windings are on opposite ends of a common coil form. The tuning core of the primary winding, L216-A, is positioned toward the chassis hole and the tuning core of the secondary winding, L216-B, is positioned in the top of the coil form. To adjust L216-B, use a hexagonal tool that will pass through the core of L216-A.

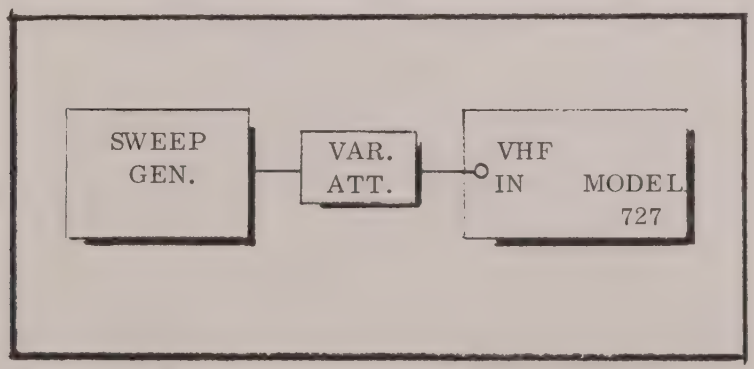


Fig. 15 Setup for Discriminator Alignment

3.5.6 Tune L216-A for maximum indication on the meter, readjusting the variable attenuator as necessary to keep the maximum reading at 4 dB.

3.5.7 Tune L216-B to the null point: the point where turning the core in either direction increases the meter deflection.

3.6 DISCRIMINATOR ALIGNMENT (AIR-SIGNAL METHOD)

3.6.1 If a steady television signal is available it can be used for aligning the discriminator. Apply the signal through the variable attenuator to the VHF INPUT terminal on the 727.

3.6.2 Tune the 727 to a carrier (video or sound) of the signal and adjust the variable attenuator for a 4 dB reading on the meter.

3.6.3 Switch on the 727 audio amplifier.

3.6.4 The discriminator coil windings are on opposite ends of a common coil form. The tuning core of the primary winding, L216-A, is positioned toward the chassis hole and the tuning core of the secondary winding, L216-B, is in the top of the coil form. To adjust L216-B, use a hexagonal tool that will pass through the core of L216-A.

3.6.5 Tune L216-A for a maximum indication on the meter, readjusting the variable attenuator as necessary to keep the maximum meter reading at 4 dB.

3.6.6 Tune L216-B to the null point: the point where turning the core in either direction increases the meter deflection. This should correspond to the point where minimum sync buzz is heard, when a video carrier is the signal source, or where best quality sound is heard, when a sound carrier is the signal source.

REPLACEMENT PARTS LIST — FIELD STRENGTH METER MODEL 727

ASSEMBLY ATTENUATOR — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITORS	
1	C101	1	0.01 uF, 600 V, disc, GMV	124-031
2	C102	1	0.75 pF, NPO	121-048
3	C103, 104	2	1000 pF, 5000 V, feed-thru	129-200
			CONNECTORS	
4	J101	1	Receptacle, F-61A	821-155
5	J102, 103	2	Receptacle	188-122
			RESISTORS	
6	R101	1	510 K Ω, 5%, 1/4 W	112-947
7	R102-105	4	240 K Ω, 5%, 1/4 W	112-948
8	R106, 108	2	144 Ω, 2%, 1/2 W	115-200
9	R107	1	107 Ω, 2%, 1/2 W	115-199
10	R109, 111, 112, 114, 115, 117, 118, 120	8	91 Ω, 2%, 1/2 W	115-198
11	R110, 113 116, 119	4	371 Ω, 2%, 1/2 W	115-197
			SWITCHES	
12	S101	1	Spdt, slide	162-033
13	S102-106	5	Dpdt, slide	-62-032

REPLACEMENT PARTS LIST FIELD STRENGTH METER
MODEL 727

ASSEMBLY AUDIO AMPLIFIER REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITORS	
1	C301, 303	2	0.02 uF, 25 V, disc, GMV	124-065
2	C302	1	10 uF, 16 V, electrolytic	127-092
3	C304	1	4 uF, 10 V, electrolytic	127-091
4	C305, 307	2	125 uF, 16 V, electrolytic	127-060
5	C306	1	0.64 uF, 64 V, electrolytic	127-080
			RESISTORS	
6	R301	1	47 kΩ, 5%, 1/4 W	111-004
7	R302, 307	2	10 kΩ, 5%, 1/4 W	112-949
8	R303, 311	2	33 kΩ, 5%, 1/4 W	111-003
9	R304	1	15 kΩ, 5%, 1/4 W	112-990
10	R305	1	430 Ω, 5%, 1/4 W	112-100
11	R306	1	150 kΩ, 5%, 1/4 W	111-020
12	R308	1	36 Ω, 5%, 1/4 W	112-978
13	R309	1	3.9 kΩ, 5%, 1/4 W	112-979
14	R310	1	82 kΩ, 5%, 1/4 W	111-019
15	R312	1	4.7 kΩ, 5%, 1/4 W	111-001
16	R313	1	100 Ω, 5%, 1/4 W	112-950
17	R314	1	200 Ω, 5%, 1/4 W	112-984
18	R315	1	100 kΩ, 5%, 1/4 W	112-935
			TRANSISTORS	
19	Q301, 302, 303	3	MPS-6516, Motorola	130-168
20	Q304	1	2N1309	130-127
21	Q305	1	2N1308	130-136

REPLACEMENT PARTS LIST — FIELD STRENGTH METER
MODEL 727

ASSEMBLY BANDPASS FILTER — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITORS	
1	C701	1	47 pF, 5%	126-102
2	C702	1	5.6 pF, 0.5%, TCZ	121-044
3	C703	1	68 pF, 5%	126-099
4	C704	1	30 pF, 2%, TCZ	121-019
5	C705	1	62 pF, 5%	126-107
6	C706, 711, 716	3	22 pF, 2%, TCZ	121-015
7	C707	1	36 pF, 2% TCZ	121-021
8	C708, 710	2	560 pF, 5%	126-029
9	C709	1	270 pF, 5%, 500 V	126-116
10	C712, 715	2	51 pF, 5%	126-085
11	C713	1	15 PF, 5%, 500 V	126-125
12	C714, 718, 722	3	3.3 PF, 0.25%, TCZ	121-006
13	C717, 723	2	3.6 pF, 0.25%, TCZ	121-061
14	C719, 721	2	4.7 pF, TCZ	121-007
15	C720	1	2-8 pF, trimmer, NPO	128-542
16	C724-727	4	3.9 pF, 0.25%, TCZ	121-045
17	C728-733	6	1000 pF, feed-thru	129-200
			CONNECTORS	
18	J701	1	Receptacle	188-122
19	P701, 702, 703	3	Connector	183-252
			SWITCHES	
20	S701A	1	Wafer	161-147
21	S701B	1	Wafer	161-148
22	S701C	1	Wafer	161-149

REPLACEMENT PARTS LIST — FIELD STRENGTH METER MODEL 727

ASSEMBLY I-F AMPLIFIER — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITORS	
1	C201, 202	2	4-12 pF, trimmer	128-545
2	C203, 204 212, 213	4	100 pf, feed-thru	129-156
3	C205, 214	2	9-50 pF, trimmer	128-544
4	C206- 215, 218, 221, 222, 224, 228	7	1000 pF, 500 V. GMV	123-115
5	C207	1	0.35-1.37 pF, trimmer	128-541
6	C208, 209, 210, 216, 217, 219, 220, 223, 229, 230, 232-241	20	0.02 uF, +80%, -20%, 25V	124-065
7	C211	1	0.7-3 pF, trimmer	128-515
8	C225	1	1 pF, TCZ	121-003
9	C226	1	15 pF, 2%, TCZ	121-013
10	C227	1	100 pF	124-058
11	C231	1	10 pF, TCZ	121-011
12	C244	1	5 pF	121-008
13	C245	1	4000 pF, 10%, 200 V, cer. disc	124-147
			CONNECTORS	
14	J201, 204	2	Receptacle	188-122
15	J202, 203	2	Receptacle	821-155
16	J205	1	Socket	182-103
			DIODES	
17	CR201, 202 203	3	IN34, Kemtron	139-100
18	CR204, 205	2	S2069, Fairchild	137-300
			RESISTORS	
19	R201	1	5.6 kΩ, 5%, 1/4 W	112-919
20	R202, 208, 214, 219, 224	5	8.2 kΩ, 5%, 1/2 W	111-002

REPLACEMENT PARTS LIST — FIELD STRENGTH METER
MODEL 727

ASSEMBLY I-F AMPLIFIER — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			RESISTORS (cont.)	
21	R203	1	1.5 kΩ, 5%, 1/4 W	112-996
22	R204, 206, 212, 217, 226	5	330 Ω, 5%, 1/4 W	112-097
23	R205, 211, 216	3	24 Ω, 5%, 1/4 W	112-985
24	R207, 213, 218, 225	4	1.8 kΩ, 5%, 1/4 W	112-972
25	R209, 215	2	16 kΩ, 5%, 1/4 W	112-933
26	R210/S201	1	300 Ω, potentiometer with spst switch	S 118-173
27	R220, 221	2	100 kΩ, 5%, 1/4 W	112-935
28	R222, 235	2	3.6 kΩ, 5% 1/4 W	112-999
29	R223	1	100 Ω, 5%, 1/4 W	112-950
30	R227	1	10 kΩ, 5%, 1/4 W	112-949
31	R228	1	4.7 kΩ, 5%, 1/4 W	111-001
32	R229	1	18 kΩ, 5%, 1/4 W	112-991
33	R230	1	470 Ω, 5%, 1/4 W	112-101
34	R231	1	2.7 kΩ, 5%, 1/4 W	112-931
35	R232	1	47 kΩ, 5%, 1/4 W	111-004
36	R233	1	1.2 kΩ, 5%, 1/4 W	112-921
37	R234	1	10 kΩ, 20%, 1/4 W, potentiometer	118-138
38	R236	1	6.8 kΩ, 5%, 1/4 W	111-005
39	R237, 239	2	15 kΩ, 5%, 1/4 W	112-990
40	R238	1	200 Ω, 20%, 1/4 W, potentiometer	S 118-140
			TRANSISTORS	
41	Q201	1	TA2401, RCA — SD1310 / 36 479 RCA 130-138	130-140
42	Q202-208	7	S1140, Fairchild	130-112

REPLACEMENT PARTS LIST — FIELD STRENGTH METER
MODEL 727

ASSEMBLY FRONT PANEL — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CONNECTORS	
1	J5	1	Receptacle, F-61A	821-155
2	P102, 103, 204, 207	4	Connector	183-252
3	P205	1	Plug	184-013
			METER	
4	M1	1	0-200 uA	171-224
			PILOT LIGHTS	
5	DS1	1	Lamp, NE-2H	102-513
6	DS2	1	Lamp, Gem-Lite 100-A-M525	102-011
7	DS3, 4	2	Lamp, GE 337	102-012
8	DS5	1	Lamp, GE 47	102-002
			RECTIFIER	
9	CR1	1	150 mA, 70 V	137-718
			RESISTORS	
10	R1	1	33 kΩ, 5%, 1/2 W	112-548
11	R2	1	470 Ω, 5%, 1/2 W	112-317
12	R3	1	150 Ω, 5%, 1/2 W	112-254
13	R5	1	510 kΩ, 5%, 1/2 W	112-704
14	R6	1	75 kΩ, 1%, 1/2 W	115-223
15	R7/S6	1	100 kΩ, potentiometer with spst switch	118-154
			SPEAKER	
16	---	1	2-1/2", PM, 45 Ω	107-032
			SWITCHES	
17	S1	1	Wafer	161-150
18	S2	1	Spdt, pushbutton	164-001
19	S3	1	Spst, pushbutton	164-002
20	S4	1	Dpdt, toggle, momentary action	162-036
21	S5	1	Spdt, pushbutton	164-003

REPLACEMENT PARTS LIST FIELD STRENGTH METER
MODEL 727

ASSEMBLY MIXER REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITOR	
1	C801	1	100 pF, 5%	126-091
			CONNECTORS	
2	J801, 802	2	Receptacle	188-122
			DIODES	
3	CR801-804	4	IN82A, Microwave Assoc.	139-190

REPLACEMENT PARTS LIST — FIELD STRENGTH METER
MODEL 727

ASSEMBLY POWER SUPPLY — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			BATTERY	
1	INT. BATT.	1	12 V, 0.6 Ah, Gould MP-202W	106-002
			CAPACITORS	
2	C601, 602	2	0.01 uF, 600 V, disc, GMV	124-031
3	C603	1	250 uF, 25 V, electrolytic	127-062
4	C604	1	5000 pF, 600 V, disc, GMV	124-029
5	C605	1	25 uF, 25 V, electrolytic	127-076
			RECTIFIERS	
6	CR601, 602 604	3	150 mA, 100 PIV	137-718
7	CR603	1	IN711, International Rect.	137-742
			RESISTORS	
8	R601, 606	2	1.6 kΩ, 5%, 1/4 W	111-012
9	R602	1	6.8 kΩ, 5%, 1/2 W	112-464
10	R603	1	1 kΩ, 5%, 1/2 W	112-359
11	R604	1	1 kΩ, 20%, 1/10 W, potentiometer	118-136
12	R605	1	2.2 KΩ 5%, 1/2 W	112-401
			TRANSISTORS	
13	Q601	1	2N456A	130-104
14	Q602, 603	2	2N1309	130-127

REPLACEMENT PARTS LIST — FIELD STRENGTH METER
MODEL 727

ASSEMBLY REAR PANEL — REF. DWG. NO.: 861-829

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CONNECTORS	
1	J1	1	Jack, closed circuit	185-100
2	J2	1	Three-prong a-c plug	188-125
3	J3	1	Tip jack, red	185-112
4	J4	1	Tip jack, black	185-109
			FUSE	
5	F1	1	0.5 A, 3AG	101-236
			RESISTOR	
6	R4	1	150 Ω, 5%, 1/2 W	112-254

REPLACEMENT PARTS LIST FIELD STRENGTH METER
MODEL 727

ASSEMBLY VHF TUNER REF. DWG. NO.: 861-779

ITEM	SCHEMATIC DESIGNATION	QTY	DESCRIPTION	JERROLD PART NO.
			CAPACITORS	
1	C401, 403, 407, 409, 414, 416, 421, 423, 427	9	1000 pF, feed-thru	129-200
2	C402	1	56 pF, 5%, 100 V	124-138
3	C404, 424	2	4.7 pF, 500 V, NPO	124-061
4	C405, 412 419, 425	4	0.7-3 pF, trimmer	128-515
5	C406, 411, 418	3	3.3 pF, 500 V, NPO	124-117
6	C408	1	10 pF, 5%, 500 V	124-137
7	C410, 417, 426, 428	4	2.2 pF, 500 V, NPO	124-064
8	C413	1	1.5 pF, TCZ	121-004
9	C415	1	6.8 pF, 5%, 600 V, NPO	124-112
10	C420	1	1 pF	121-003
11	C422	1	39 pF, 5%, 500 V, NPO	124-126
			RESISTORS	
12	R401, 404, 407, 410	4	300 Ω, 5%, 1/4 W	112-096
13	R402, 405 408, 411	4	3.3 kΩ, 5%, 1/4 W	112-936
14	R403, 406	4	10 kΩ, 5%, 1/4 W	112-949
			TRANSISTORS	
15	Q401-404	4	S1140, Fairchild	130-112

SCHEMATIC
FIELD STRENGTH METER
MODEL 727

UHF TUNER

VHF TUNER

C861-779-0

CABLE ASSY. B659-140-0
P102 TO J102

SUB. OSC
MED. OSC
TO -10 VDC ON B.P. FILTER
HI OSC.
LO OSC.

J201
TO P703

IF AMPLIFIER

COAXIAL RESONATOR 52 MHz

J202 TEST POINT NO. 1

VIDEO OUTPUT J5

PUSH-TUNER COMP. PULL-MAN. GAIN

MAX. GAIN SET

S201

TUNER COMP.

J203 T.P. NO 2

J204

P204

J801 RF INPUT

MIXER

J802 IF OUTPUT

0-200 UA M-1

VOLTAGE RANGE

TO S1A "FRONT"

RECORDER OUT

R.F. MEASUREMENT

BATT. CHECK

SEE WIRING VIEW

P205

J205

METER

-10 VDC

AUDIO

GND

ATTENUATOR

SUB. 5-50 MHz

LO 54-108 MHz

MED 108-162 MHz

HI 162-216 MHz

S701A FRONT

S701A REAR

S701B FRONT

S701B REAR

S701C FRONT

S701C REAR

TO LO OSC.
REG.-10 V
TO MED. OSC.
TO HI OSC.
TO UHF TUNER
TO SUB OSC.

P701 TO RFINPUT CONN. ON MIXER

P702 TO MIXER IF OUTPUT

P703 TO J201 INPUT OF IF AMP

TO C427 VHF TUNER

S6 AUDIO ON-OFF

AUDIO AMPLIFIER

-10V

J102 UHF
J103 VHF
P103
J701
P704

S1A FRONT
S1B FRONT
S1B REAR

TO S4

INT BATT OFF
EXT BATT
AC CHG

B1 POWER SELECTOR SWITCH FRONT PANEL SEE NOTE 4

SEE J2 WIRING VIEW

P2

J2

F1 1/2 AMP

T1

DS1 NE-2H

R1 33K 1/2W, 5%

CHARGE LIGHT DS2

R3 150 1/2W, 5%

CR1 CER68A

R2 470Ω 1/2W, 5%

S2 LIGHT SWITCH

METER LIGHTS

DIAL

DS3 DS4 DS5

R4 150 1/2 W, 5%

S3 BATTERY INTERLOCK

INT BATTERY 12 VOLTS 600 m.A.h.

J4 EXT. BATT.

J3

-10 VOLTS

CR601 CER 68A

CR 602

CER68A

Q601 2N4918

Q602 2N1309

Q603 2N1309

CR603 1N711

CR604 CER68A

S701 FREQUENCY RANGE SWITCH FRONT PANEL SEE NOTE 5

NOTES:
1. UNLESS OTHERWISE SPECIFIED;
   A. ALL CAPACITOR VALUES GIVEN IN pF.
   B. ALL RESISTORS IN OHMS, 5%, 1/4 W.
2. ALL UNMARKED CAPACITORS ARE .02 UF.
3. ATTENUATOR RESISTORS R106 THRU R120 INCLUSIVE ARE 2%, 1/2 W.
4. S1 SHOWN IN OFF POSITION.
5. S701 SHOWN IN "A" (5-50MHz) POSITION

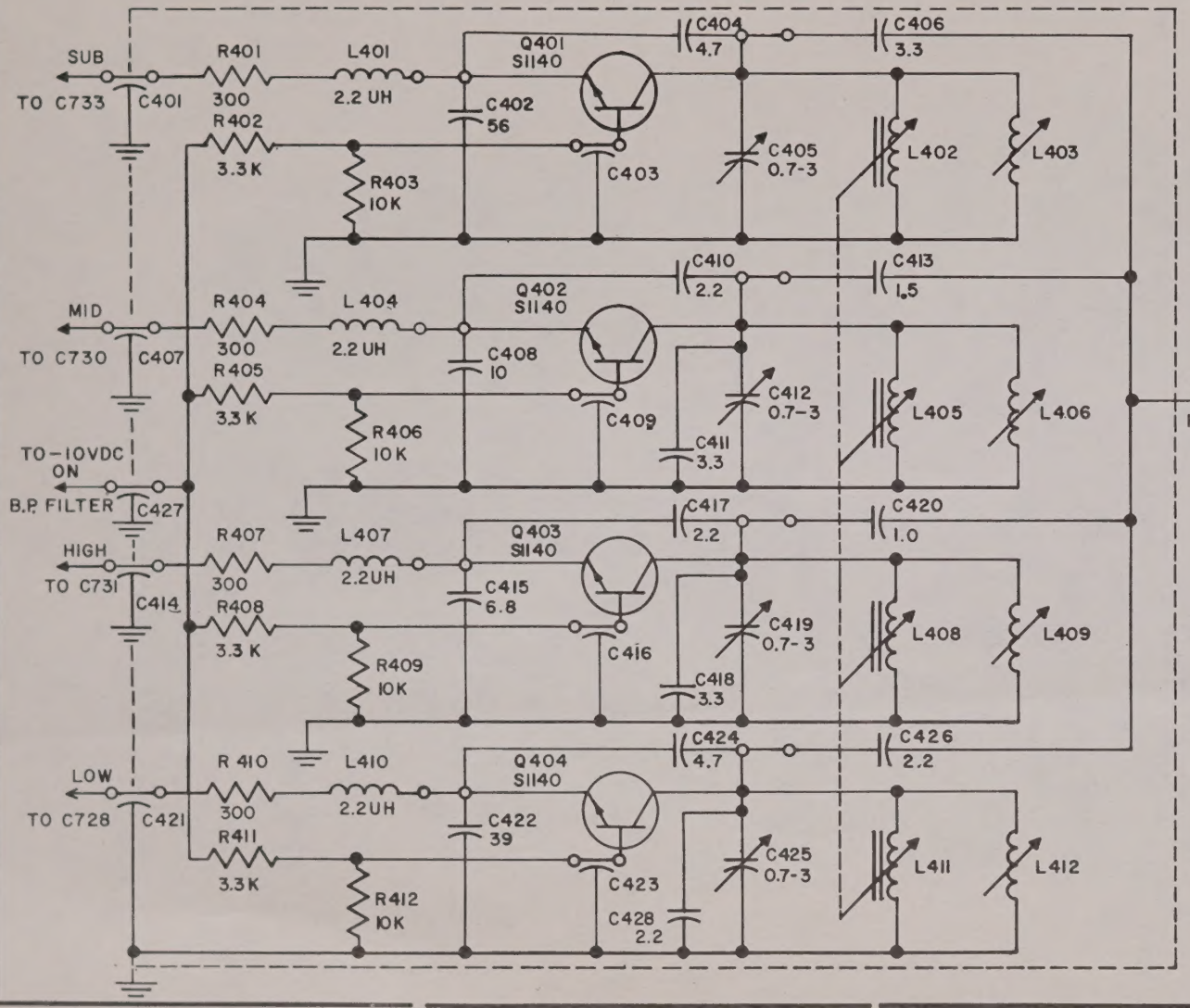
J205 AS VIEWED FROM WIRING SIDE (BOTTOM)
P205 AS VIEWED FROM WIRING SIDE (TOP)

J2 VIEWED FROM WIRING SIDE

E861-829-C

SCHEMATIC

VHF TUNER FOR MODEL 727



NOTES:

1. ALL RESISTORS ARE 5%, 1/4 WATT.
2. ALL CAPACITORS ARE IN pF.
3. ALL UNMARKED CAPACITORS ARE 1000 pF.

C861-779-A